

Stability of organic carbon: Mineral protection versus chemical recalcitrance

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In soils, oxide nanoparticles are important by creating a large reactive soil surface area, typically in the range 1-50 m²/g. The charge of metal (hydr)oxide surfaces promote the binding of organic matter as well as oxyanions such as phosphate. Organic matter may associate with oxide nanoparticles building an organo-mineral fraction where phosphate and organic matter are in competition for binding to the oxide surface. In addition, organo-mineral association may also contribute to the stabilisation of organic matter against microbial decomposition and oxidation. However, carbon may also be stable in soils by its inherent chemical nature, e.g. in case of black carbon.

An improved methodology based on work of Mikutta et al. (2006) with a mild chemical oxidation (NaClO) and mineral dissolution (HF) has been applied to differentiate between stable and instable organic matter and to determine the role of mineral protection versus chemical recalcitrance. In addition, the reactive oxide surface has been determined by measuring the phosphate release upon diluting soils with NaHCO₃ (Hiemstra et al. 2010). These approaches have been applied to understand stabilization of organic matter soils focussing on antropogenic Plaggen soils versus Terra Preta soils.

[1] Mikutta, R., et al (2006). *Biogeochemistry*, **77**, 25–56. [2] Hiemstra, T. et al. (2010) *Geochim Cosmochim Acta*, **74**(1), 41–58